JAMES W. HOWSE IV
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EDUCATION:

Ph.D. in Electrical Engineering, Dec. 1995 — University of New Mexico, Albuquerque, NM

Thesis Advisors:	Dr. Chaouki T. Abdallah and Dr. Gregory L. Heileman
Dissertation Title:	Gradient and Hamiltonian Dynamics: Some Applications to Neural Network Analysis and System Identification.

M.S. in Electrical Engineering, May 1990 — University of Central Florida, Orlando, FL

Honors & Awards: Tau Beta Pi, Eta Kappa Nu, Litton Fellowship

B.S. in Engineering Physics, June 1986 — Lehigh University, Bethlehem, PA

CAREER-RELATED EXPERIENCE:

Technical Staff Member at Los Alamos National Laboratory (LANL) in Los Alamos, NM from 3/98 to the present. *Postdoctoral Researcher* with Dr. Kevin Buescher at LANL from 6/96 to 2/98. Worked on the following projects during this time.

- Weapons Tomography Project: Developing signal and image processing methodologies for obtaining 3-dimensional density reconstructions of objects based on a small number of noisy 2-dimensional projection images. The projections are produced by transmission tomography of both static and dynamic objects using either X-ray or proton beams. The number of different densities in the objects is fairly small, so reconstruction from a small number of projections is probably achievable. Formulating a reconstruction technique based on support vector regression in order to obtain error bounds on the density estimates, and efficiently incorporate knowledge of the projection physics into the reconstruction via the regression kernels. Also writing computer codes for iteratively solving constrained least squares problems and developing methods to speed convergence of these solvers.
- Blast Furnace Control Project: Derived a model based on heat and mass transport for the heating and cooling cycles of the thermal regenerators used to supply heat to the blast furnace. Wrote a two-dimensional simulation of the partial differential equations describing the heating and cooling processes, and a parameter estimation procedure to fit this model to measured regenerator data. Developed a model predictive controller which minimizes fuel consumption while maintaining sufficient heat in the regenerators to satisfy the process requirements, and wrote computer code to solve this optimization problem. Initial audits by the company indicate that the controller is reducing the amount of fuel used per quantity of heat produced by 6% or about $500,000 annually. Also developing an anomaly detection strategy for determining the onset of periods of substandard blast furnace operation called chilled hearths. This will allow corrective measures to be instituted in order to prevent the condition. Wrote an algorithm to estimate the Bayes error from empirical data using a nearest neighbor technique, as part of the feature selection process associated with detector design.
- Security and Safety Monitoring for Radioactive Experiments Project: Designed and conducted experiments to characterize the detection and tracking of radioactive sources using gamma radi-

ation sensors at a LANL facility. Analyzed the experimental data to determine the radial and angular antenna pattern of the sensors. Developed a detection algorithm based on non-parametric hypothesis testing to determine the presence of radioactive sources in the facility. Developed a tracking algorithm based on nonlinear state estimation to track source locations using real-time sensor data. This algorithm is similar to a Kalman filter which uses Poisson distributed measurement noise and allows state constraints.

- Biological Weapons Non-proliferation Project: Derived a technique for converting both deterministic and stochastic epidemiological models into a form which could be simulated on a digital computer, and derived two identification techniques for determining the model parameters from data about the actual spread of a disease.

Research Assistant for Drs. Abdallah and Heileman at the University of New Mexico in Albuquerque, NM from 8/91 to 5/96. Conducted basic research into the analysis of the dynamics in recurrent neural networks. Used control theory and dynamical systems theory concepts to develop a mathematical formalism which unifies the analysis of Lyapunov stability, phase space behavior, and structural stability for many existing neural network paradigms. Extended this by developing a formalism which decomposes system dynamics into the sum of dissipative (e.g., convergent) and conservative (e.g., periodic) components. Used this formalism to develop a class of nonlinear models and an associated learning algorithm which are guaranteed to solve certain types of nonlinear identification problems. Wrote software to simulate the various models and verify results. This work was funded by a contract from Boeing Computer Services.

Research Assistant for Dr. Robert F. Cromp at NASA / Goddard Space Flight Center in Greenbelt, MD from 5/92 to 8/92. Performed basic research into the development and analysis of unsupervised learning algorithms for the automatic characterization of remotely sensed satellite images. The work was used to examine Landsat TM and MSS data, AVHRR data, and SAR data. Developed software for these algorithms.

Research Assistant for Dr. Gamal (Jim) M. Moharam at the Center for Research in Electro-Optics and Lasers (CREOL) in Orlando, FL from 3/89 to 5/90. Wrote software to simulation diffraction effects in acousto-optic and photorefractive media. Assisted with the construction of a unique optical correlator that determined whether two input frequencies were identical through acousto-optic and photorefractive optical device technology. This work was funded by a contract from Harris Government Systems.

Senior Staff Technologist for Dr. Davis H. Hartman at Bellcore in Morristown, NJ from 5/87 to 5/88. Responsible for the research and development of a new process to produce channel waveguides from radiant curing polymers for use in optical interconnects. Researched and tested various materials. Investigated both photolithographic and laser writing techniques to produce the waveguides. Measured the loss characteristics of optical waveguides. To accommodate different waveguides types, designed experiments using three coupling schemes; end-fire, prism and a unique wedge. Assembled and in some cases machined the necessary components for each experiment. Collected and analyzed the data for each waveguide.

SKILLS:

- Extensive experience programming in C and FORTRAN
- Extensive experience with a variety of Unix operating systems
- Experience using SPlus, Matlab, Mathematica, and Maple

AFFILIATIONS:

Institute of Electrical and Electronic Engineers

Society of Industrial and Applied Mathematics

PUBLICATIONS:

"Least Squares Estimation Techniques for Position Tracking of Radioactive Sources", J.W. Howse, L.O. Ticknor, and K.R. Muske, *Automatica*, Vol. 37, No. 11, pp. 1727–1737, 2001.

"Comparison of recursive estimation techniques for position tracking radioactive sources", K.R. Muske and J.W. Howse, *Proceedings of the 2001 American Control Conference*, Arlington, VA, June 2001, pp. 1656–1660, 2001.

"Product property monitoring for a batch polymerization reaction system", K.R. Muske, J.W. Howse, and D.R. Hush, *Proceedings of the 2001 American Control Conference*, Arlington, VA, June 2001, pp. 987–992, 2001.

"Solving a Thermal Regenerator Model using Implicit Newton-Krylov Methods", J.W. Howse, G.A. Hansen, D.J. Cagliostro, and K.R. Muske, *Numerical Heat Transfer: Part A - Applications*, Vol. 38, No. 1, pp. 23–44, 2000.

"Model-Based Control of a Thermal Regenerator. Part 1: Dynamic Model", K.R. Muske, J.W. Howse, G.A. Hansen, D.J. Cagliostro, *Computers and Chemical Engineering*, Vol. 24, No. 11, pp. 2521–2533, 2000.

"Model-Based Control of a Thermal Regenerator. Part 2: Control and Estimation", K.R. Muske, J.W. Howse, G.A. Hansen, D.J. Cagliostro, *Computers and Chemical Engineering*, Vol. 24, No. 11, pp. 2509–2519, 2000.

"Lagrangian solution methods for nonlinear model predictive control", K.R. Muske, J.W. Howse, and G.A. Hansen, *Proceedings of the 2000 American Control Conference*, Chicago, IL, June 2000, pp. 4239-4243, 2000.

"Temperature Profile Estimation for a Thermal Regenerator", K.R. Muske, J.W. Howse, G.A. Hansen, and D.J. Cagliostro, *Proceedings of the 1999 Conference on Decision and Control*, Phoenix, AZ, December 1999, pp. 3944-3949, 1999.

"On-line process model of a hot blast stove", K.R. Muske, J.W. Howse, G.A. Hansen, and D.J. Cagliostro, *1999 AIChE National Meeting*, Dallas, TX, November 1999, paper 213a, 1999.

"Recursive Estimation for the Tracking of Radioactive Sources", J.W. Howse, L.O. Ticknor, K.R. Muske, *Proceedings of the 1999 American Control Conference*, San Diego, CA, June 1999, pp. 1905-1909, 1999.

"Hot blast stove process model and model-based controller", K.R. Muske, J.W. Howse, G.A. Hansen, D.J. Cagliostro, and P.C. Chaubal, *Proceedings of the 1998 AISE Annual Conference*, Pittsburgh, PA, September 1998, paper 48, 1998.

"Blast furnace stove control", K.R. Muske, G.A. Hansen, J.W. Howse, D.J. Cagliostro, and P.C. Chaubal, *Proceedings of the 1998 American Control Conference*, Philadelphia, PA, June 1998, pp. 3809–3810, 1998.

"Implicit Newton–Krylov methods for modeling blast furnace stoves", J.W. Howse, G.A. Hansen, D.J. Cagliostro, and K.R. Muske, *Proceedings of the 1998 AIAA/ASME Joint Thermophysics and Heat Transfer Conference*, Albuquerque, NM, June 1998, pp. 283–290, 1998.

"Model-based hot blast stove control and optimization", K.R. Muske, G.A. Hansen, J.W. Howse, D.J. Cagliostro, and P.C. Chaubal, Presented at the *1997 AIChE National Meeting*, Los Angeles, CA, paper 197c.

"A Learning Algorithm for Applying Synthesized Stable Dynamics to System Identification", J.W. Howse, C.T. Abdallah, and G.L. Heileman, *Neural Networks*, Vol. 11, No. 1, pp. 81–87, 1998.

"Some Control Theoretic Issues in Neural Networks", J.W. Howse, C.T. Abdallah, and G.L. Heileman, *International Conference on Neural Networks*, Washington, DC, June, 1996, IEEE Press, Vol. Special Sessions, pp. 205–210, 1996.

"Gradient and Hamiltonian Dynamics Applied to Learning in Neural Networks", J.W. Howse, C.T. Abdallah, and G.L. Heileman, *Advances in Neural Information Processing Systems*, Denver, CO, November 1995, MIT Press, Vol. 8, pp. 274–280, 1996.

"An Application of Gradient-Like Dynamics to Neural Networks", J.W. Howse, C.T. Abdallah, G.L. Heileman and M. Georgiopoulos, *SouthCon*, Orlando, FL, March 1994, IEEE Press, pp. 92–96, 1994.

"Total Stability of Dynamical Neural Networks", J.W. Howse, C.T. Abdallah, G.L. Heileman and M. Georgiopoulos, *World Congress on Neural Networks*, Portland, OR, July, 1993, INNS Press, Vol. 4, pp. 280–284.

"Radiant Cured Polymer Optical Waveguides on Printed Circuit Boards for Optical Interconnection Use", Hartman, Lalk, and Howse, *Applied Optics*, Vol. 28, No. 1, pp. 40–47, 1989.